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ABSTRACT

This synthesis offers a descriptive inventory of research studies of cooperative learning at the secondary level. While cooperative learning techniques vary, they all share an interest in finding an alternative to "frontal teaching"--the teacher instructing the whole class or individual seatwork by students. Cooperative methods allow students to work in small groups under the assumption that cooperative tasks are more likely to motivate students to learn and provide more individual help for students. Cooperative learning is also advocated for improving social relations between races, ethnic groups, high and low achievers, or for increasing productivity in problem solving. A summary is presented on studies of five major techniques for implementing cooperative learning in grades 7-12. Twenty-seven reports of high quality studies were reviewed, involving 37 comparisons of cooperative versus control methods. The effectiveness of cooperative learning is discussed along with implications for practice. Data collected in the studies are presented on 10 pages of tables and a list of 56 references is included. (JD)

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EFFECTS OF COOPERATIVE LEARNING ON ACHIEVEMENT IN SECONDARY SCHOOLS: A SUMMARY OF RESEARCH

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EXECUTIVE SUMMARY

COOPERATIVE LEARNING

A research literature on cooperative learning techniques in elementary and secondary schools has developed since the early 1970s, although most of the research has occurred in elementary school classrooms. Because secondary schools differ substantially from elementary schools and because adolescents' behavior and motivation may differ in significant ways from younger children's, it is important to take a special look at cooperative learning research at the secondary level. This synthesis offers a descriptive inventory of studies of cooperative learning research at the secondary level, a summary of results, and interpretive remarks about the significance and state of research. It is limited to an examination of effects on achievement, although it is recognized that the goals of education and cooperative learning extend beyond academic achievement.

Cooperative learning techniques vary, but they all share an interest in finding an alternative to "frontal teaching"--the teacher instructing the whole class at once--or to individual seatwork by students. Instead, cooperative methods ask students to work in small groups, on the assumptions that cooperative tasks are more likely to motivate students to learn, will provide more individual help for students and will, as a result, improve achievement. Cooperative learning is also advocated for its promotion of other goals such as improved social relations between races, ethnic groups, high and low achievers, or for increased productivity in problem solving.

Five major techniques that have been investigated in grades 7-12 are summarized and discussed in this review. Each assumes a traditional classroom of one teacher and many students, organized into heterogeneous ability groups of four to five students working together to learn material. The techniques include students within teams helping one another to learn material and public recognition of teams which show high gains in individual students' scores (Student Teams-Achievement Divisions); students helping one another learn material, and earning points for their team by competing against classmates of similar achievement from other teams (Teams-Games-Tournament); students receiving unique information on a topic, working with members of other teams to master material and finally returning to their teams to teach it to their teammates (Jigsaw); small group work on assignments that produce a single group product without competition between groups (Learning Together); and small group work that entails each group in the class taking on a different task or project (Group Investigation).

Twenty-seven reports of high quality studies were reviewed, involving 37 comparisons of cooperative versus control methods. Twenty-five (68%) of these comparisons favored a cooperative learning method at the .05 level of significance. Twenty-eight of the comparisons of main effects on overall achievement reported information sufficient to compute effect sizes, and these ranged from -.87 to 5.15. This overall success rate is 10% higher than reported in the most recent review.

This review adds new information to previous reviews by summarizing the distribution of secondary school studies by grade level, subject, technique, duration in weeks, sample size, and type of achievement measure. Most studies have occurred in grade seven, and the greatest success was found in grades eight and nine. Science has attracted the most studies, but mathematics and Language Arts have the highest success rates. Of the five learning techniques reviewed, Student Teams-Achievement Divisions has been most consistently successful (89%), Jigsaw clearly the least successful (17%). Teams-Games-Tournaments (75%), Learning Together (73%), and Group Investigation (67%) all show high success.

More research is needed, especially in grades 10-12, in most subjects and with most techniques (especially Group Investigation), but future studies should pay more attention to the interactive effects of method, level of thought, student background characteristics (ability, gender, race-ethnicity, learning style preference), and student status within group. Most importantly, it should address the specific types of verbal interaction within groups that are most likely to boost achievement.

The findings bring good news to teachers interested in the potential of cooperative learning in secondary school grades. It is likely, however, that successful implementation in grades 10-12 will require significant teacher preparation on how to reorient high school students to new classroom procedures and also on the teaching of specific cooperative skills to students. In short, these techniques offer no simple strategies for boosting student achievement in high schools, but materials developed for teachers, even those aimed at lower grade levels, can be helpful.

I INTRODUCTION

Since the early 1970s a research literature has developed on cooperative learning techniques in elementary and secondary schools. The methods vary considerably, but they all share an interest in finding an alternative to the dominant classroom scenario of either "frontal teaching"--the teacher instructing the whole class at once--or to individual seatwork by students. Instead, cooperative methods ask students to work in small groups. The expectation is that cooperative tasks are more likely to motivate students to learn, that they will provide more individual help for students, and, as a result, achievement will be improved over traditional methods. Cooperative learning is also advocated for its promotion of other goals such as improved social relations between races, ethnic groups, high and low achievers, or for increased productivity in problem solving. Previous reviews have found results consistent with these expectations.[1] This broad conclusion, however, offers insufficient guidance for practitioners, because it fails to take into account the possibility of differential effects due to diversity among cooperative learning techniques, subject matter, grade level, and background characteristics of students.[2]

Although cooperative learning techniques were developed initially for college and adult education, most of the research has occurred in elementary school classrooms. Because secondary schools differ substantially from elementary schools--in size, organizational structure, approaches to the teaching of subjects, and because adolescents' behavior and motivation may differ in significant ways from younger children's, it is important to take a special look at cooperative learning research at the secondary level. This review offers a descriptive inventory of studies, a summary of results, and interpretive remarks about the significance and state of research. It is intended not as a comprehensive, critical review of the field, but as a "best evidence" synthesis to inform practitioners and researchers of what we know about the effects on achievement of studies of cooperative learning in secondary school classrooms.

The review is limited to an examination of effects on achievement, but we recognize that the goals of education and of cooperative learning extend beyond academic achievement. Many of the studies emphasize and find positive effects on students' social and affective development, especially in relation to cross-racial and inter-ethnic friendship and interaction; on their cooperative and on-task behavior; on attitudes toward cooperative activity; and on students' sense of efficacy and satisfaction with learning. Most of the studies that include achievement measures also report results on variables of this sort, but several studies exclusively emphasize social relations or non-cognitive outcomes without including achievement measures. A synthesis of the effects on the social and affective outcomes of cooperative learning with secondary students is also needed.[3]

II COOPERATIVE LEARNING TECHNIQUES

We summarize below the major techniques that have been investigated in secondary schools.[4] Each technique assumes a traditional classroom of one teacher and many students, organized into heterogeneous ability groups of four to five students working together to learn material. The organization of learning tasks, the ways in which achievement is assessed, and the types of rewards given for individual and group performance vary, depending on the method. Acronyms are given first to facilitate reading of the tables.

STAD Student Teams-Achievement Divisions (Slavin, 1978). The teacher presents a lesson. Students meet in four- to five-member teams, helping one another to master a set of worksheets on the lesson. Each student takes a quiz on the material. The individual scores, based on the degree of individual improvement over previous scores, contribute to a team score. Teams with high scores are recognized in a weekly class newsletter.

TGT Teams-Games-Tournament (DeVries and Slavin, 1978). Instruction is similar to STAD, with students trying to help one another learn the material. But instead of taking individual quizzes, students compete with classmates of similar achievement from other teams. Based on their relative success against competitors from the other teams, students earn points for their own team, and teams with high scores are publicly recognized.

JIG Jigsaw (Aronson, 1978). Each student in a five- to six-member group is given unique information on a topic that the whole group is studying. After reading their material, the students meet in "expert groups" with their counterparts from other teams to discuss and master the information. Next they return to their teams to teach it to their teammates. In a variation called "Jigsaw II" (Slavin, 1980b), all students are first given common information. Then student "experts" teach more specific topics to the group. Finally, students take tests individually, and team scores are publicized in a class newsletter.

LT Learning Together (Johnson & Johnson, 1975). Students work in small groups on assignments to produce a single group product. Teachers use various methods for nurturing a philosophy of cooperation based on five elements: positive interdependence, face to face interaction, individual accountability, social skills, and group processing. Students are instructed to seek help from one another before asking for teacher assistance. Students are usually rewarded on a combination of their own individual performance and the overall performance of the group. Rewards include teacher praise, grades, tokens and privileges, but neither individuals nor groups compete with one another.

GI Group Investigation (Sharan & Sharan, 1976). Students work in small groups, but each group takes on a different task or project, and within groups, students decide what information to gather, how to organize it, and how to present what they have learned as a group project to classmates. In

evaluation, higher level learning is emphasized (applications, synthesis and inferences).[5]

All the approaches encourage students to help one another to learn, and all aim to promote both achievement and improved social relations, but there are significant differences in methods that reflect differences in theoretical perspective and educational philosophy. The first two approaches, for example, place more emphasis on individual testing of predefined academic material and upon individual and group competition to improve scores. In contrast, the last three rely more upon intrinsic student interest in cooperation and upon teacher praise of the group as a whole. Group Investigation is the most open-ended form and assumes that students take considerable responsibility for directing the learning.

Differences among the methods may stem from the extent to which cooperative learning is promoted primarily as a means to individual achievement and accountability versus group productivity and social understanding. Writings on STAD and TGT emphasize ways in which students' competitive motivation can be constructively channeled to compete with one's own previous achievement and with one's peers at a similar level. At the same time, one's achievement benefits from and contributes to a group effort, which itself is driven by the excitement of group competition. The ultimate reward is individual achievement, along with improved social relations among students who have learned to give and receive help from one another. To implement this approach requires training in new classroom procedures, but, because the techniques are designed to be compatible with dominant motivations of students in school (to compete for high grades), relatively little reorientation to schooling is needed.

In contrast, discussions of LT, JIG, and GI advocate cooperative learning largely as a way to reduce negative forms of individualism and competition, that is, to enhance skills in cooperative behavior, pride in group productivity, and in students' getting along with members from diverse social backgrounds (especially race, ethnicity, and physical handicap). Implementing this philosophy in American schools requires, for most students and teachers, a commitment away from privatism and competitive individualism toward a cooperative way of life. Thus, successful implementation of the method is likely to require for teachers and students alike not simply the learning of techniques, but also training in new skills of social interaction as well as possible reconsideration of the ends and means of education.

These issues have been discussed at a more technical level in terms of the consequences that might be expected from different activity structures represented in the different techniques. In making the case for cooperative learning, David and Roger Johnson, for example, focus on distinctions among cooperative, competitive, and individualistic goal structures (Johnson and Johnson, 1975; 1985). Robert Slavin (1983b), on the other hand, argues for a cooperative task structure (i.e., tasks in which neither individual nor group work can be completed unless people cooperate), a cooperative reward structure (when individuals are rewarded for group accomplishment), and

individual accountability (the contribution of each individual group member is publicly visible). We will not review here the implications of different philosophies and classroom contingencies, but their significance should not be underestimated.

III REVIEW AND SUMMARY PROCEDURE

We selected studies of cooperative learning in grades 7-12 which met the following criteria: an experimental treatment which involved cooperative tasks and a group product or group reward structure; the use of a control or comparison group; a sample of at least 20 students; a duration of at least two weeks (10 school days); and individual testing of student achievement. The rationale for cooperative learning emphasizes not mainly the learning of isolated information or skills that might be taught in a few lessons, but the improvement of achievement over the long term. We chose two weeks as a minimum on the grounds that shorter interventions are less likely to provide a valid test of the strategy. To locate the studies, we searched for published and unpublished material, relying upon previous reviews and suggestions from authorities in the field.

We located twenty-seven studies that met these criteria, and they are summarized in Table 1.[6] The studies were of high methodological quality. Most used intact classes and randomly assigned treatments to classes. Within classes, students were usually randomly assigned to treatments, stratified by ability. To control for teacher effects, the studies either randomly assigned teachers to methods, assigned teachers to use more than one method, or used statistical analysis to describe teacher effects. Almost all studies reported pre-test comparisons between treatment groups and/or used proper statistical controls for pre-test differences.[7]

Table 1 is organized in four parts corresponding to each of the grade levels 7, 8 (a few of these studies also included 6th and 7th grade students), 9, and 10-12. The first page of each part contains primary data on the study: grade level, author, subject area, sample size, duration, method of cooperative learning, method of control or comparison, the type of achievement measure, and achievement results.[8]

The cooperative methods have been described above in general terms, but the studies may include potentially important details about both the experimental and control conditions that are not represented in the table. For example, control conditions in the TGT and STAD studies include vigorous efforts by the teachers to teach the material, but in LT experiments, students in the control condition of individualized study are to learn the material on their own, asking the teacher for help when needed. For more information on the achievement measures, the specific studies can also be consulted, but they rarely included examples of test items.

Following Slavin (1980a), results on the dependent variables were summarized according to the following procedure. A "+" indicates an effect favoring the experimental treatment at the .05 level of significance, 0 indicates no

difference, and "-" indicates a difference (at the .05 level) favoring a comparison or control group. In general, we summarized only the main treatment effects. Several studies report interaction effects, but these are too complicated to represent in the table. In a few instances, however, where particularly interesting interactions were found, we included them. In studies where several experimental treatments or control conditions were used, we list the treatment that is favored or disfavored by the statistical test. Whenever possible we also computed an effect size, listed in parentheses, by finding the difference in mean gain between experimental and control group (or between post-test means adjusted for pre-test as covariates) and dividing this by the post-test standard deviation of the control group.[9]

The second page of Table 1 presents background information. "Student characteristics" refers to whatever information on student ability and social background was given in the study; unfortunately this information is often vague and incomplete. In most studies, teachers received some training in the use of cooperative methods, and the extent of training is indicated, also based on often vague information given in the study.[10] Finally, the geographic location of the study is listed.

IV RESULTS

A. General Profile

Based on the information in Table 1, a profile of the distribution of studies across grade levels, subject areas, the cooperative learning techniques tested, duration, and number of students involved is given in Table 2, along with the percentages of comparisons that found positive achievement results for cooperative methods.[11] The overall success rate of comparisons between cooperative learning and control conditions is 68 percent, higher than Slavin's (1983b) finding for secondary studies (57%), and close to the 70 percent positive rate he found for elementary studies.

As has been consistently emphasized in literature on research syntheses, merely counting the number of significant results is often not very informative (even when only the highest quality studies have been included), because statistical significance alone gives no indication of the magnitude of effects. We attempted to compute effect sizes for the studies, but unfortunately, sufficient information (means and standard deviations) was reported in only 13 of the 27 reports. The 28 effect sizes for main treatment effects on overall achievement measures ranged from -.87 to 5.15, for a mean effect size of 1.19.[12] This estimate must be interpreted with caution, however, because effect sizes could not be computed for most of the comparisons, and 11 of the 12 effect sizes (for main treatment effects on overall achievement) that exceed 1.0 come from the studies by Okebukola in Nigeria. Because the size of these results differ so markedly from studies in the United States, they deserve special scrutiny.

The frequencies in Table 2 offer a general profile of success rates. The greatest number of studies have occurred in grade 7, but studies in grade eight

and nine have the highest success rate. Grades 10-12 have attracted the fewest studies and have the lowest rates of success. Studies exist in each of the subject areas, but science dominates in number, and the success rates of mathematics and English are the highest. The technique of STAD offers the largest number of comparisons and has the highest success. GI has received the least research attention, but JIG has recorded the least success. The rates of success according to duration of treatment suggests the benefits of treatments longer than three weeks. We would expect statistical significance to increase with the sample size, but the findings indicate that sample size alone is a poor indicator of success rate.

The frequency of study success distributed by techniques, subject and grade is given in Table 3. This table can be used to find more precisely the concentration of studies as well as gaps in the research. Fifteen science studies have been completed, but only two exist in grade seven. In grades 10-12, there have been no studies of Language Arts and only one of mathematics and social studies. STAD has been used nine times, but only once in science and social studies and never above grade nine. It would seem that JIG, LT and GI lend themselves particularly to social studies, but there are no studies reported of any of these methods in social studies beyond 8th grade.

B. Specific Issues

This general profile should be interpreted through an examination of the individual studies presented in Table 1. In reflecting upon the diverse set of studies, we call attention below to three issues: possible reasons for the lack of positive results, the nature of achievement measures, and findings of special interest.

1. Reasons for the Lack of Positive Results

We searched for trends among the twelve instances in which comparisons failed to yield a "+" for a cooperative method. Could the failures be attributed to such factors as the amount of teacher preparation, the percentage of low ability students, the number of students in the experiment, or the cooperative method used? Teacher preparation within the unsuccessful studies varied from 6 to 42 hours with no discernible difference from the successful studies. Most of these studies involved students of diverse abilities; only two involved high proportions with low achievement or motivation. On the suspicion that cooperative techniques might be more effective with low ability students, all studies were examined to see whether authors had tested for interaction between treatment and student characteristics such as ability or ethnicity. Only eight of the twenty-seven studies reported such analyses: four found no interaction, one found that TGT favored low ability students (#7-3, Edwards et al., 1972); two found that STAD had greater positive effects on blacks than whites (#7-10, Slavin, 1977; and #8-5, Slavin & Oickle, 1981); one found that LT is most effective with low ability students when they work within mixed ability groups (#9-6, Okebukola & Ogunniyi, 1984). There is, therefore, little evidence on whether students' prior achievement or ethnicity determines the success of cooperative techniques. Neither would small sample size explain

lack of success, for the number of subjects per study was usually large. Among the unsuccessful comparisons, the smallest sample was 46, seven had more than 100, and five had more than 200 students.

The best explanation for lack of success points to aspects of the cooperative method itself. The largest discrepancy in representation between the total group of studies and the unsuccessful ones is found with JIG which accounted for 17% of the total comparisons, but 46% of the unsuccessful ones. This is reflected in the low success rate for JIG in Table 2. The representations of LT and GI among the unsuccessful studies were equivalent to their proportion among all study comparisons. In contrast, STAD and TGT accounted for 52 percent of all study comparisons, but only 36 percent of the unsuccessful ones.

Slavin (1983b) has argued that the critical elements of success for cooperative learning techniques are a combination of group reward and individual accountability; a cooperative task structure is not enough. The results are consistent with this conclusion. JIG generally involves only a cooperative task structure, but neither group reward nor individual accountability. Compared to JIG, the higher success rates for LT and GI may be due to their provision of group rewards, but these methods usually do not formally link individual accountability to group rewards, and this may explain why STAD and TGT which involve both group rewards and individual accountability succeed more often.

2. Achievement Measures

The studies include both standardized and treatment-specific curriculum tests, with no apparent differences in success rates between the two types. We did not review copies of the tests, but from the study reports, we gather that the tests focused almost exclusively on lower order cognitive tasks involving recognition, recall, and skills involving algorithmic application of rules (especially in grammar and mathematics). None of the studies used writing or speaking exercises, and only two studies reported the use of higher level cognitive questions. When considering achievement, therefore, we must remember that the research has little to say about the effect of cooperative learning on students' higher level problem-solving activity or on their production of discourse. A good case can be made that cooperative group work is particularly useful and necessary in the development of critical thought and in forming productive responses to problems that suggest multiple solutions, with no conclusive answers. In this sense, it is unfortunate that achievement measures to date have focused largely on recall or application of rules of grammar and arithmetic.

3. Findings of Special Interest

Okebukola's (1985) study of eighth grade science (Table 1, Part II) offers the most comprehensive comparison among cooperative learning methods. He used five experimental treatments (LT, JIG, TGT, STAD, and independent study where students competed for high scores). The control group was traditional

whole class instruction. Since the independent study treatment involved no cooperation, we categorized it as a second control group. The achievement measure was a locally developed test of science achievement consisting of subtests of low and high cognitive levels. All cooperative methods showed greater total gains than both traditional whole class instruction and independent study and competition. The magnitude of the advantage was consistently in a direction from LT (lowest) to STAD (highest).[13] This is the only study that has compared so many of the methods simultaneously.

Another unique contribution of the study is its investigation of results on low versus high cognitive level items. On low cognitive items, the eight comparisons between cooperative methods and the two control methods found cooperative methods to hold a significant advantage only three times, a considerably lower percentage of success (38%) than we found in the full range of studies. In contrast, all cooperative methods showed exceptional, even monumental, advantages for higher cognitive items, with TGT and STAD again out-performing JIG and LT. Over all methods, students' performance on high cognitive items was consistently lower than on low cognitive items, but every cooperative method substantially out-performed control methods on the high cognitive subtest. The finding suggests that the general superiority of the cooperative methods was due to their contribution to higher cognitive learning. If, as recommended above, outcome measures included more attention to higher cognitive items, we might find even more impressive results for cooperative learning techniques than have been found in the studies thus far.

Okebukola's study (1986b) of ninth grade science (Table 1, Part III) offers other interesting results. He hypothesized that the effects of cooperative versus competitive learning depend upon students' preference for one style over the other, and that these preferences may be determined by environmental or "eco-cultural" factors. Using a special questionnaire on preference for cooperative or competitive work, he found that students in rural agricultural communities with a distinctly communal pattern of living generally preferred cooperative work, while students in an urban center, living in self-contained apartments with minimal interpersonal helping in the community preferred competitive work. Biology was taught using LT as the cooperative method. Individual study with competitive quizzes was the comparison. Students were assigned to treatments so that each method was taught to students who both preferred and did not prefer it. The overall comparison between methods yielded no significant difference, but students who learned by their preferred method, whether cooperative or competitive, out-performed by a wide margin (effect size 1.8) those who were mismatched.

The finding casts a significant qualifier on conclusions about cooperative learning, because it suggests that students may perform equally well in cooperative and competitive conditions so long as the teaching technique matches their preference. By restricting the cooperative condition to LT, this study did not test the relationship of student preference to techniques such as STAD and TGT which contain a <u>combination</u> of cooperation and competition. In fact, in the previous study Okebukola (1985) found that while all cooperative methods succeeded over controls, those classes that used a

combination of cooperation and competition (STAD and TGT) outperformed both the "pure" cooperative classes (JIG and LT) and the "pure" individual competition classes. This finding is further reinforced by Okebukola (1986a) in which the treatment of LT combined with grade competition between groups produced substantially greater effects than LT alone. Although further research on this issue is needed, especially in United States schools, these findings suggest that rather than choosing between purely cooperative and purely individual competitive methods it would be desirable to match students according to their preference, and, when this is not feasible, to include cooperation within small groups with some competition between groups.

V DISCUSSION

This review mapped the distribution of cooperative learning studies in grades 7-12 and found frequent positive effects on student achievement, but important questions remain. We will address two that have received little attention: Why is there such low participation and success in grades 10-12? What does the research suggest about how to improve the effectiveness of students working in small groups?

A. Low Participation and Success in Grades 10-12.

We did not conduct a survey of actual practice, but we assume that the frequency of research studies is in some way proportionate to the use of or enthusiasm for these techniques in schools. Grades 10-12 constitute 50% of the grade levels examined, but of the 37 comparisons between cooperative and control methods, only 6 (16%) occurred in grades 10-12. How might we explain this apparently cold reception of cooperative learning in high school? Perhaps it reflects a considered judgment by teachers that cooperative learning is not likely to work in high school, for this review yields a success rate of only 33% (and no information on effect size) in grades 10-12.

Lest these findings become a self-fulfilling prophecy, it should be noted that of the four studies that failed to find a significant effect (see Table 1, Part IV), three used JIG which has had many unsatisfactory results at lower grade levels as well. The other "0" in grades 10-12 was an experiment with GI whose impact, according to the authors (Sherman and Zimmerman, 1986), suffered primarily because the experiment occurred in the final weeks of the school year. Students had established their friendship circles and study patterns, and they resisted the change in classroom norms. Furthermore, no special preparation for teachers was reported in any of these four studies. Thus, it would be wrong to conclude from this data alone that most forms of cooperative learning are destined to failure in grades 10-12.

We have no systematic data to show that high school teachers are less willing than others to use cooperative methods, but based on our experience, we believe this is a strong possibility.[14] Teachers may view students aged 15-18 as less responsive to the kinds of rewards (recognition in class newsletter, tokens, special privileges) given in earlier grades. Teenagers may have more instrumental self-interest in school than younger children, preferring to receive

knowledge directly from the more knowledgeable teacher, rather than "wasting time" teaching and learning from peers. As competition for grades increases in high school, many students may value individual achievement over group cooperation. High school teachers, who feel the pressure to cover large amounts of complicated material, and who, in contrast to teachers in lower grades, spend less time each day with their students, probably perceive considerable inefficiencies in relying upon students to teach one another, especially if the new approaches require additional training and practice time.

Such concerns indicate the need for major efforts in staff development to properly introduce cooperative learning. Practitioners consulted in this review have emphasized this point, but have also described with great enthusiasm the success of cooperative learning in high schools when students and teachers are adequately assisted in making the change from individual, competitive and whole class instructional formats. Although we have concentrated only on benefits to academic achievement, secondary school practitioners also show considerable interest in affective benefits, especially increasing inter-racial friendship and cooperation.

B. Improving the Effectiveness of Cooperative Small Groups

Discussions of the effectiveness of different cooperative learning techniques have focused largely on structural matters such as differences between cooperative, competitive and individualistic goal structures; the relative importance of task structure, incentive structure and individual accountability; or the effect of between-group competition. In a sense, the research has sought to identify those forms of social organization within classrooms most likely to stimulate students to try their hardest, and, therefore, to achieve.

Studies of cooperative learning, however, have given less attention to the quality of student interaction within groups that is most likely to lead to achievement and how to cultivate those forms of interaction.[15] If high school students require special incentives and training to cooperate, and if teachers are to be asked to make fundamental changes, it is even more important to gain clarity about the particular quality of interaction within groups that boosts achievement. We suggest that two important lines of research on small groups be applied more systematically to studies of cooperative learning.

The first deals with the specific ways in which students can be helpful to one another. Webb (1985) has shown that in general an individual's giving and receiving of help within groups has no effect on individual achievement, but that the type of help given and received does.[16] For example, giving substantive explanations has a major positive effect, but giving short-answer, terminal responses has none. Receiving explanations can have a positive effect, but receiving terminal responses has a negative effect and receiving no response to a request for help has an even more negative effect. Further research is needed, but the studies to date indicate that if students are to be helpful to one another in small groups, they need to learn how to ask for and how to provide constructive help.

The second line of research should examine how group composition affects the quality of student interaction. Although all of the studies we reviewed used groups composed of students of "heterogeneous" ability, cooperative learning may have shown greater benefits if the following more specific findings on grouping were taken into account.

Webb (1985) found that the range of ability within groups affects interaction. Homogeneous groups of medium ability and groups of either medium to high or medium to low were most likely to elicit wide student participation in giving explanations. In heterogeneous groups that spanned the full range of ability, high ability students offered a greater proportion of explanations. These were directed primarily to low-ability students, and medium ability students tended to remain passive.

Webb (1984) also found that gender composition affected the degree of differential participation by males and females in giving of explanations. When males or females were in the majority, males were more effective in obtaining help. In high achieving classes, males also showed more effective interaction, but in low-achieving classes these differences did not occur (Webb and Kenderski, 1985).

Related to and consistent with Webb's findings, Cohen (1986) found that students' status within groups affected their interaction with peers which in turn affected individual achievement. Students of high "costatus" (those perceived as both most competent in the subject and most popular) talked and worked together more frequently than low costatus students, and as a result they became even more competent. A subsequent intervention that trained all students to participate and that created special roles (e.g., facilitator, checker, reporter) to ensure broader participation decreased the dependence of student achievement on costatus. This suggests that in applying the findings about specific types of help to be given and received, special attention must be paid to differential participation according to student status.

In short, research which links the quality of interaction (especially, asking for and giving explanations) with group composition in terms of ability, gender, race and other dimensions of status has powerful implications for maximizing the benefits of learning in cooperative small groups.

VI SUMMARY AND IMPLICATIONS FOR PRACTICE

A review of the research on cooperative learning on academic achievement in grades 7-12 produced twenty-seven reports of high quality studies, involving thirty-seven comparisons of cooperative versus control methods. Twenty-five (68%) of these comparisons favored a cooperative learning method at the .05 level of significance. Twenty-eight of the comparisons of main effects on overall achievement reported information sufficient to compute effect sizes, and these ranged from -.87 to 5.15. This overall success rate is 10% higher than reported in the most recent review (Slavin, 1983b).

We have added new information to previous reviews by summarizing the distribution of secondary school studies by grade level, subject, technique, duration in weeks, sample size, and type of achievement measure. Most studies have occurred in grade seven, and the greatest success in grades eight and nine. Science has attracted the most studies, but mathematics and Language Arts have the highest success rates. Of the five learning techniques reviewed, Student Teams-Achievement Divisions has been most consistently successful (89%), Jigsaw clearly the least successful (17%). Teams-Games-Tournaments (75%), Learning Together (73%), and Group Investigation (67%) all show high success.

The pattern of results supports the importance not only of a cooperative task structure, but also of group rewards, of individual accountability, and probably of group competition as well. Few studies have tested students on higher order cognitive tasks, but the three that report such measures (Sharan et al, 1984; Johnson et al, 1985; Okebukola, 1985) found positive effects.

More research is needed, especially in grades 10-12, in most subjects and with most techniques (especially Group Investigation), but future studies should pay more attention to the interactive effects of method, level of thought, student background characteristics (ability, gender, race-ethnicity, learning style preference), and status within group. Most importantly, it should address the specific types of verbal interaction within groups that are most likely to boost achievement.

The findings bring good news to teachers interested in the potential of cooperative learning in secondary school grades. It is likely, however, that successful implementation in grades 10-12 will require significant teacher preparation on how to reorient high school students to new classroom procedures and also the teaching of specific cooperative skills to students. In short, at the high school level, these techniques offer no easy panacea, but handbooks and other resources have been developed to assist teachers. Even those materials aimed at lower grade levels, can be helpful (especially, Slavin, 1986; Kagan, 1985b; Johnson and Johnson, 1984; Johnson et al, 1984; and Sharan & Sharan, 1976).

In exploring their use, teachers should be mindful of substantial differences among the methods and of problems that remain to be solved, such as the cultivation of high quality interaction within learning groups among students of low and high status and ability, and between males and females. In the quest for improved achievement, we should also remember that previous research on affective benefits, not reviewed here, has demonstrated substantial effects of cooperative methods on outcomes such as cross-racial and ethnic friendship, attitudes toward learning, and other affective aims of education.

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ENDNOTES

1. The most comprehensive reviews are found in Johnson and Johnson (1985a), Johnson, Johnson & Maruyama (1983), Johnson et al. (1981), and Slavin (1980a, 1983a, 1983b).

2. Research has addressed differential effects of cooperative, competitive and individualistic activities (Johnson and Johnson, 1985b; Okebukola, 1985), and, within cooperative techniques, the influence of different task structures and reward structures (Kagan, 1985c; Slavin, 1983a, 1983b). However, little attention has been devoted to the interaction of cooperative techniques with different grade levels, subject matter, or type of student.

3. General reviews on these variables are provided by reports cited in Note 1, but none contain special analyses of effects in secondary classrooms.

4. Having limited this review to five main approaches to cooperative learning, we do not pretend to synthesize research on the broader issue of the type of student interaction within groups that is most likely to boost achievement. More focused research on this issue (for example, on the giving and receiving of help) is needed to complement reviews of the general techniques. For a summary of research on student interaction and learning in small groups, see Webb (1985).

5. An advanced form of Group Investigation which has not been extensively studied in secondary schools is Co-op Co-op (Kagan, 1985a). Originating at the university level, and similar to GI, teams choose topics that contribute to a general topic studied by the whole class. Within teams, individuals are assigned minitopics which they research and integrate into a team presentation. Evaluation may focus on individual and group work.

6. Some studies not included in the final list because of lack of a control group, short duration, or small number of students indicated achievement results that favored cooperative methods. See for example, Lew et al. (1983); Mesch et al. (1986); Nevin, Johnson and Johnson (1982).

7. Some exceptions to these conditions were found. The method of teacher assignment to treatment was unclear in the following studies: 7-2 (Edwards & DeVries, 1972); 9-4 (Okebukola, 1986c); 10-3 experiment 1 (Lazarowitz et al., 1985); 10-4 (Sherman & Zimmerman, 1986). The following studies did not use, report, nor control for pre-test scores: 8-2 (Johnson et al., 1985), 8-3 (Johnson et al., 1986); 10-2 (Johnson & Johnson, 1982); 10-3 Lazarowitz et al. (1985).

8. Language Arts refers to the teaching of English grammar, vocabulary, and general use of the language in writing and speech. It is often called "English," but we use Language Arts to emphasize the teaching of composition rather than literature. No studies of "English" which might combine composition and literature were found above grade eight.

9. For studies that used two-group designs and reported analysis of variance statistics, we derived an effect size estimate from the F statistic and number of subjects in each group:

$$ES = \sqrt{F} \times \sqrt{1/n_1 + 1/n_2}$$

10. In several studies teacher preparation was offered through university courses and involved more time than would be necessary for in-service education.

11. Following the convention used by Slavin (1983b), if an intervention within a subject area used more than one achievement measure, we awarded it a "+" if at least half of the measures within that subject area showed a positive effect over one control group. The total number of entries here and in Table 3 (37) exceeds the number of authored studies (27), because some studies include achievement results for more than one subject area, more than one cooperative learning technique, or more than one experiment.

12. If we assume a normal distribution of achievement and of gains in achievement, we can translate effect size (the difference between experimental and control gain as a proportion of the control group standard deviation) into the amount of advantage that could be expected from participation in the experimental group. A control group student whose gain score or post-test adjusted score is at the 50th percentile or median of the control group would, as a member of an experimental group, benefit from different effect sizes as follows:

effect size	from 50th percentile to
.20	58th
.50	69th
.80	79th
1.0	84th
2.0	98th

Another way of translating this is to note that with an effect size of 1.0, the average student in the experimental group scores at the 84th percentile of the control group.

13. Okebukola (1986b) also compared the techniques as three groups: "pure" cooperative (LT and JIG), cooperative-competitive (TGT and STAD), and "pure" competition (IND). Analysis of variance indicated that the cooperative-competitive methods had greater positive impact than either the "pure" cooperation or the "pure" competition. This will be discussed later in observations about activity and reward structures.

14. Davis (1985) reported resistance to cooperative learning techniques by high school teachers, and Sharan et al. (1984) reported resistance by junior high teachers.

15. Interaction has been frequently studied in relation to affective outcomes, but the kind of interaction within cooperative learning groups that is most likely to produce group and individual achievement has received little attention. While research on this topic is rare, significant efforts have been made to train students (usually in elementary grades) to behave cooperatively (see, for example, Cohen, 1986; Slavin, 1986; Johnson et al., 1984).

16. See also Webb (1983) and Webb and Kenderski (1984).

Table 1

Summary of Secondary Cooperative Learning Studies

Part I: 7th Grade
Primary Data

	STUDY	SUBJECT	N	DURATION (weeks)	METHOD OF COOPERATIVE LEARNING	CONTROL METHOD	ACHIEVEMENT MEASURE	ACHIEVEMENT RESULTS
7-1	Edwards & DeVries, 1974	Mathematics Social Studies	120	12	TGT (3 variations)	Traditional instruction, individual study and weekly quizzes	Math divergent solutions I Math divergent solutions II Computations Number sentences Social Studies: Maps Capitols	+ + 0 0 0 0
7-2	Edwards & DeVries, 1972	Mathematics	117	4	TGT used with "Equations" twice a week	Traditional lecture, individual assignments & quizzes	Divergent solutions test Computations subtest of Stanford Achievement Test in Mathematics	0 0
7-3	Edwards, DeVries & Snyder, 1972	Mathematics	96	9	TGT, with "Equations" game, traditional lecture, individual assignments & quizzes	Traditional lecture, individual assignments & quizzes	Divergent solutions test Computation subtest of Stanford Achievement Test in Mathematics	+ +
7-4	Hulten & DeVries, 1976	Mathematics	299	10	TGT (4 variations)	Traditional instruction, with game-like activities that reward high student scores	Stanford Achievement Test, arithmetic computation	+(.33)
7-5	Johnson, Johnson, DeWeerdt, Lyons, Zaidman, 1983	Science	50	2	LT (teacher praise)	Same script as LT, but individualistic learning, avoiding interaction with other students	Curriculum test of factual recall	0
7-6	Okebukola, 1986a	Science	131	24	LT (teacher praise) LT (teacher praise) plus group competition (GC)	Whole class instruction (WC) Individual competition in small groups (COMP)	Science achievement test Experimental group, compared to: LT LT+GC	WC: +(3.45), +(5.15); COMP: +(1.33), +(3.04)
7-7	Rich, Amir, Slavin, 1986	Literature History	674	14-18	"Intensive" treatment including JIG, plus a special social relations enhancement (SRE) program to develop positive ethnic relations	JIG,SRE, traditional	Literature test History test	- -
7-8	Sharan et al., 1984	Literature English as a 2nd Language	848	16 12	GI,STAD	Whole class lecture, demonstrations, audio-visual aids, questioning techniques	Literature test: low level questions high level questions English test: listening comprehension reading comprehension cloze test asking questions total score	0 +GI(.65)+STAD(.42) +GI(.34)+STAD(.28) 0 0 0 +GI(.10)+STAD(.12)
7-9	Slavin, 1978b	Language Arts	205	10	STAD (3 variations)	Individual study according to same schedule as STAD classes, but no newsletter or comparative scores	Hoyum Sanders Jr. High English Test Curriculum test	0 0
7-10	Slavin, 1977	Language Arts	65	9	STAD	Same worksheets, schedule and tests as STAD, but no teams or newsletter	Hoyum Sanders Jr. High English Test Treatment specific test	Overall: +(.77), +(.36); Whites: 0, 0; Blacks: +, +

TABLE 1 (CON'T)

Part I: 7th Grade
Background Information

STUDY NUMBER	STUDENT CHARACTERISTICS	TEACHER PREPARATION IN COOPERATIVE LEARNING	LOCATION
7-1	49% black, average ability	6 hours, plus occasional follow-up	Urban East
7-2	Average math ability	6 hours, plus occasional follow-up	Urban East
7-3	Average and low math ability	6 hours, plus occasional follow-up	Urban East
7-4	White, working class	6 hours, plus occasional follow-up	Urban East
7-5	Diverse, 9 severely handicapped	2 of 4 teachers highly trained	Suburban Midwest
7-6	Diverse	1 month, plus 3-hour follow-up	Oyo, Nigeria
7-7	Diverse ethnicity and ability	40 hours of summer workshops	Israel
7-8	Heterogeneous ability, Western (45%); Middle Eastern (55%)	42 hours of workshop training	Israel
7-9	Majority white	6 hours, plus occasional follow-up	Rural East
7-10	Majority black	6 hours, plus occasional follow-up	Urban East

TABLE 1 (CON'T)

Part II: 8th Grade
Primary Data

	STUDY	SUBJECT	N	DURATION (weeks)	METHOD OF COOPERATIVE LEARNING	CONTROL METHOD	ACHIEVEMENT MEASURE	ACHIEVEMENT RESULTS
8-1	DeVries, Lucasse, & Shackman, 1979 (Grades 7-8)	Language Arts Mechanics	1187	10	TGT (2 variations), with TGT English curriculum materials	Individualized, Random House English Series	Hoyum-Sanders Jr. High School English Test Treatment-specific test	0 +
8-2	Johnson, Johnson & Stanne, 1986	Geography	75	2	LT with computer simulation (group grade)	Individual use of computer, worksheets, test scored competitively (COMP) Individual use of computer, worksheets, criterion referenced test (IND)	Completed worksheets Accuracy of worksheets Computer game score Final exam	+ + + +
8-3	Johnson, Johnson & Stanne, 1985	Geography	71	2	LT with computer simulation (group grade)	Individual use of computer, worksheets, test scored competitively (COMP) Individual use of computer, worksheets, criterion referenced test (IND)	Questions completed Questions correct Factual test Application test Problem-solving test	+ + + + +
8-4	Okebukola, 1985	Science	630	5	LT, (teacher praise) JIG, TGT, STAD	Individual study and competition (IND) Traditional whole class instruction (WC)	Science achievement test	

Experimental group, compared to:	Total Score WC	Total Score IND
LT	+(.95)	+(.50)
JIG	+(1.41)	+(.87)
TGT	+(2.40)	+(1.69)
STAD	+(2.52)	+(1.79)

Experimental group	compared to:	Low Cognitive Items WC	Low Cognitive Items IND	High Cognitive Items WC	High Cognitive Items IND
LT		0	0	+(7.70)	+(2.02)
JIG		0	0	+(9.39)	+(2.78)
TGT		0	+(.29)	+(13.25)	+(4.52)
STAD		+(.27)	+(.42)	+(13.52)	+(4.62)

8-5	Slavin & Oickle, 1981 (Grades 6-8)	Language Arts	230	12	STAD	Same schedule worksheets, quizzes, but studied independently rather than in teams	Hoyum-Sanders Jr. High English test overall whites blacks	 +(.33) 0 +(.88)

TABLE 1 (CONT'D)

Part II: 8th Grade
Background Information

STUDY NUMBER	STUDENT CHARACTERISTICS	TEACHER PREPARATION IN COOPERATIVE LEARNING	LOCATION
8-1	Heterogeneous ability	3 hour workshop on use of TGT; Control teachers also have 3 hour workshop on individualized method	Suburban Midwest
8-2	Middle class	90 hours training on structuring competitive, cooperative & individualized learning	Midwest
8-3	Middle class	90 hours in structuring cooperative, competitive and individualistic learning	Suburban Midwest
8-4	Heterogeneous ability	20 hours of training in assigned cooperative method	Oyo State, Nigeria
8-5	33.9% black	6 hours, plus occasional follow-up	Rural East

TABLE 1 (CON'D)

Part III: 9th Grade
Primary Data

	STUDY	SUBJECT	N	DURATION (Weeks)	METHOD OF COOPERATIVE LEARNING	CONTROL METHOD	ACHIEVEMENT MEASURE	ACHIEVEMENT RESULTS
9-1	Allen & Van Sickle, 1984	World Geography	51	6	STAD	Same schedule and materials, but individual study and whole class instruction	Curriculum test	+(.94)
9-2	Humphreys, Johnson & Johnson, 1982	Physical Science	44	6	LT (group grade)	Individual study, competitive evaluation		
						Individual study, criterion referenced evaluation	Retention test	+
9-3	Okebukola, 1986b	Biology	420	6	LT (teacher praise)	Competitive individual learning and testing	Curriculum test of Biology Achievement	
							main effect of treatment	0
							interaction of treatment with student preference	+(1.8)
9-4	Okebukola, 1986c	Chemistry	223	6	LT (teacher praise)	Traditional whole class instruction	Chemistry achievement test	+(2.56)
9-5	Okebukola, 1984	Biology	720	11	LT (teacher praise)	Individual study with competition in small groups (COMP)		COMP / IND*
						Individual study without competition (IND)	Biology practical skills test	-(.87) / +(.27)
9-6	Okebukola & Ogunniyi, 1984	Science	1025	3	LT (teacher praise)	Individual study with competition in small groups (COMP)	Experimental compared to:	COMP / IND
							Science achievement test	+(.89) / +(1.07)
						Individual study without competition (IND)	Science practical skills test	-(.81) / +(.71)
9-7	Sherman & Thomas, 1986	General Mathematics	38	5	STAD with one TGT experience	Individual drill, homework, teacher lecture	Curriculum test	+(1.2)
9-8	Slavin & Karweit, 1984	General Mathematics	588	30	STAD STAD plus Mastery	Individual mastery: teaching, worksheets, quiz, corrective instruction, summative quiz	Mathematics computations and concepts and applications subscales from Comprehensive Test of Basic Skills	+(.19)

*Results of this study are tabulated as 0 in tables 2 and 3.

TABLE 1 (CONT'D)

Part III: 9th Grade
Background Information

STUDY NUMBER	STUDENT CHARACTERISTICS	TEACHER PREPARATION IN COOPERATIVE LEARNING	LOCATION
9-1	Low achievement level 70% black		Rural South
9-2	Middle achievement level Middle class	20 hours training in use of cooperative, competitive and individualistic conditions	Suburban Midwest
9-3	Diverse	Intensive training including lectures, discussion of model lessons and practice sessions	Rural & Urban Nigeria
9-4	Diverse		Nigeria
9-5	Diverse	26 hours of training	Ondo, Nigeria
9-6	Diverse	30 hours of training	Oyo, Nigeria
9-7	Low achievement level, white middle class	University training in the application of STAD/TGT	Rural Midwest
9-8	Low achievement level 76% black; 19% white		Urban East

TABLE 1 (CONT'D)

Part IV: Grades 10-12
Primary Data

	STUDY	SUBJECT	N	DURATION (weeks)	METHOD OF COOPERATIVE LEARNING	CONTROL METHOD	ACHIEVEMENT MEASURE		ACHIEVEMENT RESULTS
10-1	DeVries, Edwards, & Wells, 1974	American History	191	12	TGT (2 variations: average and weighted to boost the influence of low performing students)	Individual study, competitive evaluation	SCAT-STEP Social Studies Curriculum test		0 +
10-2	Johnson & Johnson, 1982	Mathematics	31	3	LT (teacher praise)	Students work individually, avoiding interaction with other students	Curriculum test		+(p.<.10)*
10-3	Lazarowitz, Baird, Hertz-Lazarowitz, & Jenkins, 1985								
	Experiment 1	Biology	113	6	JIG, Modified such that students used an inquiry approach covering a wide range of material; they worked almost completely independently from the teacher, and this was the only form of instruction for 2-3 weeks	Experiments 1 and 2: individualized mastery learning; Experiment 3, traditional demonstration-lecture	Curriculum test	Experiment 1	0
	Experiment 2	Geology	83	3				Experiment 2	0
	Experiment 3	Genetics	69	2				Experiment 3	-
10-4	Sherman & Zimmerman, 1986 (Grade 10 only)	Biology	46	7	GI groups of 4-5 members complete projects	Individual study and research project	Curriculum test		0

*While this failed to reach the criterion of $p < .05$, the study was included, because it met all other criteria, had a high quality design, and the small sample size (31) made statistical significance more difficult to achieve.

TABLE 1 (CONT'D)

Part IV: Grades 10-12
Background Information

STUDY NUMBER	STUDENT CHARACTERISTICS	TEACHER PREPARATION IN COOPERATIVE LEARNING	LOCATION
10-1	7% minority	6 hours, plus occasional follow-up	Suburban South
10-2	Diverse, 6 handicapped	60 hours in cooperative and individualistic methods	Metropolitan Midwest
10-3 (Experiment 1)	Low motivation & mainstreamed low ability	(Students received 4 hours training in cooperative activities)	Rural West
(Experiment 2)	Low motivation	(Students received 4 hours training in cooperative activities)	Rural West
(Experiment 3)	Heterogenous	(Student use of Modified Jigsaw in biology unit prior to this study)	Rural West
10-4 (Grade 10 only)	White middle class above average ability		Rural Midwest

Table 2

Distribution of Studies and Positive Results
According to Grade Level, Subject, Cooperative Learning
Technique, Duration of Treatment, and
Number of Students

Grade Level	7	8	9	10-12
+/N	9/15	8/8	6/8	2/6
%+	60	100	75	33

Subject	Science	Math	Language Arts	Social Studies	Literature
+/N	8/15	6/7	5/6	4/6	2/3
%+	53	86	83	67	67

Technique	STAD	TGT	JIG	LT	GI
+/N	8/9	6/8	1/6	8*/11	2/3
%+	89	75	17	73	67

Duration in Weeks	2-3	4-7	8-12	13+
+/N	4/7	8/12	9/12	4/5
%+	57	67	75	80

Number of Students	15-50	51-100	101-205	206+
+/N	3/5	5/7	3/7	14/18
%+	60	71	43	78

Overall + results = 25/37 = 68%

*Includes a study in which intergroup competition was linked with LT.

Table 3

Frequencies of Study Results by Technique, Subject, and Grade Level

	STAD	TGT	JIG	LT	GI
Science					
7				0+*	
8	+	+	+	+	
9				+0+0+	
10–12			00–		0
Math					
7		+0++			
8					
9	++				
10–12				+	
Social Studies					
7		0	–		
8				++	
9	+				
10–12		+			
Language Arts					
7	+0+				+
8	+	+			
9					
10–12					
Other (Literature)					
7	+		–		+
Total +/N	8/9 (89%)	6/8 (75%)	1/6 (17%)	8/11 (73%)	2/3 (67%)

*This study also included a positive effect when LT was combined with competition between groups.